粉介殼蟲 (*Dysmicoccus brevipes* (Ckll.)) 在鳳梨果實上之發生時期調查及其防治試驗

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一、前　　言

粉介殼蟲已早被認爲係鳳梨之最主要害蟲，該蟲在鳳梨生育期爲害之後，易引起萎凋病。故以往之防治對策，乃針對萎凋病之預防，在鳳梨定植前行浸苗及定植後連續數次灌藥，以抑制其蟲口而收防治萎凋之效。至鳳梨花芽分化前，約在定植後一年以後，對該蟲之防治，則幾已中止。因此在鳳梨開花結果後，一些殘存的粉介殼蟲，乃爬移至果實以及冠，裔芽爲害。粉介殼蟲一至鳳梨的果實和芽體，因該部位之組織較幼嫩而多汁，所以繁衍亦較快而多(3)。

近數年來，由於鳳梨生果亦拓開了外銷市場，現在之出口量已年近二萬公噸，其數量且在逐年增加。因外銷用之生果可較內銷或製罐之鳳梨早約 2～3 星期採收，且其價格亦略高些，爲一般果農所歡迎，亦爲鳳梨產業開拓了另一光明的坦途。

由於果實上有粉介殼蟲之爲害，及因該蟲分泌之蜜露（Honey dew）爲黴菌寄生後，形成一層黑煤烟狀之固結物，沾染在果實的基部，而不得外銷。商人爲應急，常僱女工用刷子刷掉在果實基部的粉介殼蟲。此法不但易於擦傷鳳梨果皮，使果實不耐貯運，而細小的粉介殼蟲幼蟲，在鳳梨果目的隙縫間亦不易被刷淨，此終非完善之辦法。

爲解決鳳梨果實上粉介殼蟲之問題，而利於外銷，得農復會 67-A13-A-1794 計劃之補助，在本省幾個鳳梨主要栽培區，先調查粉介殼蟲在鳳梨果實之發生消長，繼而用數種殺蟲劑，分別在室內和田間作防治比較試驗，現將結果整理報告如下。

二、鳳梨果實粉介殼蟲發生消長調查

本省鳳梨之產期，大別之分爲夏果及冬果。前者約佔產量之80%，其成熟期多集中在六至八月間(1)。近年來由於生果亦打開了外銷市場，爲應市場上之需要，對每月之供需，要作適度之調節，因此電石處理乃被普遍採用。且因中南部各地氣溫之差別，處理時期亦有先後，一般以臺南區較早，依序爲高雄、嘉義及南投。惟每地區仍有因鳳梨發育情形而有先後之別。故全省從二月開始至八月止，幾都有生果可以採收。

調查地區以鳳梨栽培較集中者，選南投、嘉義、臺南及高雄等四地區，按期進行。鳳梨公司的鳳梨，因有較完善之防蟲措施，蟲害發生較少，且該公司的鳳梨果實，多爲製罐之用，不予調查，故調查對象以一般果農爲主。調查時鳳梨之熟度，選已謝花後而果皮已呈綠色者，每一鳳梨園隨機調查果實五十個，每一地區調查二至四個鳳梨園不等。惟調查時每因在田間無法和園主接觸，對該鳳梨是否曾作防治粉介殼蟲之措施，不得而知。調查期間由民國五十五年十二月至五十六年八月前後調查六次。

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表一 鳳梨果實粉介殼蟲發生情形

Table 1. Occurrence of mealybug on pineapple fruit

地區 Locality	調查時期 Time of investigation	區數 No. of fields investigated	果數 Total fruits	被害率 Infestation %	爲害部位 Portions of infestation (%)				
					果柄 Stalk	果基 Base of fruit	果端 Upper of fruit	冠芽 Crown	裔芽 Slips
南投 Nantow	Dec.1966	1	50	10					
嘉義 Chiayi	Dec.	3	150	10	3.33	6.67			
高雄 Kaohsiung	Dec.	3	150	35.5	6.00	28.0	1.5		
平均 Average				15.17	3.11	11.56	0.5		
南投 Nantow	Jan.1967	3	200	22.00	2.67	16.00	1.0	2.33	
嘉義 Chiayi	Jan.	2	95	26.00	4.25	15.30	2.25	4.25	
高雄 Kaohsiung	Jan.	2	150	21.00	6.50	14.50			
平均 Average				23.00	4.47	15.27	1.08	2.19	
南投 Nantow	Mar.	2	100	11.00	8.00	9.00			
嘉義 Chiayi	Mar.	2	100	53.00	51.00	41.00	5.00	1.00	
臺南 Tainan	Mar.	2	100	19.00	18.00	12.00			
高雄 Kaohsiung	Mar.	2	100	52.00	32.00	49.00			
平均 Average				33.75	27.25	27.75	1.25	0.25	
南投 Nantow	June	4	200	40.50	38.50	25.00	3.00	5.00	14.50
嘉義 Chiayi	June	4	200	50.30	42.00	40.00	2.00	4.50	29.50
臺南 Tainan	June	4	200	47.50	38.50	25.00	2.50	2.00	15.50
高雄 Kaohsiung	June	3	150	38.00	28.67	29.33	1.33	4.00	
平均 Average				44.08	35.92	29.83	2.21	3.88	14.88
南投 Nantow	July	4	200	7.50	4.50	4.00			0.50
嘉義 Chiayi	July	2	100	22.00	12.00	14.00		1.00	1.00
臺南 Tainan	July	3	150	34.00	14.67	12.67		0.67	
高雄 Kaohsiung	July	3	150	40.00	25.33	32.67		2.67	1.33
平均 Average				25.88	14.13	15.84		1.09	0.71
南投 Nantow	Aug.	3	150	34.67	13.33	32.67	0.67	0.67	
嘉義 Chiayi	Aug.	—							
臺南 Tainan	Aug.	—							
高雄 Kaohsiung	Aug.	—							
總計 Total		52	2,695	29.43	16.37	22.15	0.95	1.35	2.60

註：嘉義，臺南和高雄地區的鳳梨在八月份都已採收完。

Pineapple fruits in Chiayi, Tainan and Kaohsiung have all been harvested in August.

依調查結果，本省各地區之鳳梨果實沾染有粉介殼蟲之成數，平均約30%左右，如此之被害率，已可謂相當嚴重。而年中之發生情形以三至六月間之爲害率從 33.75% 至 44.08% 爲最高（表一），此與粉介殼蟲年中發生消長頗相吻合(3)。至於本省各地區鳳梨果實粉介殼蟲之爲害率，亦因氣溫之高低，及鳳梨成熟期之關係，而有顯著之區分，如南投區之 19.28% 爲最低，嘉義和臺南區分別爲 32.5% 至 33.5%，不相上下，高雄區 37.3% 爲最高（表二）。

表二 各地區鳳梨果實粉介殼蟲發生比較

Table 2. Comparison of the occurrence of mealybug on pineapple fruits in several districts

地 區 Locality	調查期間 Duration of investigation	區數 No. of fields investigated	果數 Total fruits	被害率 Infestation %	被害部位 Portions of infestation (%) 果柄 Stalk	果基 Base of fruit	果端 Upper of fruit	冠芽 Crown	裔芽 Slips
南投 Nantow	Dec. 1966 to Aug. 1967	17	900	19.28	10.50	14.45	0.78	1.33	2.50
嘉義 Chiayi	Dec. 1966 to July 1967	13	645	32.25	22.52	23.39	1.85	2.05	6.10
臺南 Tainan	Mar. to July '67	9	450	33.50	23.72	16.56	0.83	0.89	5.17
高雄 Kaohsiung	Dec. 1966 to July 1967	13	700	37.50	19.70	30.70	0.57	1.33	0.27

三、殺蟲劑防治粉介殼蟲比較試驗

鳳梨粉介殼蟲之防治早經用巴拉松 47% 乳劑加水 2,000 倍，用浸苗和灌藥等方法，在全省推廣結果，效果良好。但在果實上，由於殘毒問題，以及施用方法係用噴霧而異於浸苗和灌注，所以在殺蟲劑之應用上需考慮施藥和消費者之安全，而採用毒性較低，且以目前在香蕉防治粉介殼蟲之數種殺蟲劑爲供試之藥劑如 Diazinon 60% EC, Sumithion 50% EC, Lebaycid 50% EC, Malathion 50% EC 等。此外還有兩種新殺蟲劑如 Matacil 75% WP 及 Ortho-9006 72% EC 等，係由中德及惠農兩公司分別委託在鳳梨粉介殼蟲作防治試驗，亦被加入本試驗以諸比較。

㈠ 室內藥效比較試驗：上列供試之六種殺蟲劑，各分爲五至六種濃度，先於室內作浸苗試驗。供試之鳳梨苗先定植於盆中經一個月後，把有粉介殼蟲之鳳梨葉片，放置於供試之鳳梨株上，讓粉介殼蟲自行爬上該鳳梨苗，經三週後，待粉介殼蟲都已固定時，才把鳳梨苗拔起，浸入供試殺蟲劑之稀釋液中二分鐘，每處理用鳳梨苗十株。處理一週以後調查粉介殼蟲的死亡率，其結果經用 Abbott's formula 計算，以校正自然死亡率。LC_{50} 和 Slope 之近似值，係以目測（Eye-fitted）於 Keuffel and Esser probability scale log paper No. 359-22G 求之（表三）。

在供試的六種殺蟲劑中以大利農（Diazinon）之殺蟲率最高，其供試之數種濃度，均優於其他五種殺蟲劑之同一濃度，次爲力拔山（Lebaycid）和速滅松（Sumithion），再次爲 Matacil，而馬拉松（Malathion）和 Ortho-9006 兩者最差。

㈡ 田間藥效比較試驗：經室內之殺蟲比較試驗後選其中殺蟲率較高之大利農，力拔山，速滅松和 Matacil 等四種殺蟲劑，進一步在田間噴射於鳳梨未成熟之果實，以比較其在田間之成效如何。

表三　鳳梨粉介殼蟲室內防治試驗

Table 3. Laboratory evaluation on some insecticides for control mealybug on pineapple slips

殺蟲劑 Insecticides	處理日期 Date of treatment	死亡率 Mortality (%) 濃度 Concentration (ppm)								LC50 (ppm)	Slope
		5	10	50	200	350	500	650	800		
Ortho-9006 72% EC	Dec. 24, '66			14.09	40.14	60.36	65.17	84.20	88.87	238	1.6
Malathion 50% EC	Feb. 23, '67			33.14	61.22	84.00	66.59	86.27	92.14	105	1.1
Sumithion 50% EC	Feb. 25, '67		36.78	66.98	84.88	88.25	90.36	93.36		22	1.01
Lebaycid 50% EC	Mar. 29, '67		35.90	66.18	76.59	93.28	93.80	94.15		21.5	1.13
Matacil 75% WP	April 1, '67		41.74	64.39	71.53	79.84	89.34	88.94		19	0.81
Diazinon 60% EC	Mar. 31, '67	73.40	80.95	97.45	99.52	99.04				1.67	1.32

每種殺蟲劑各用一種濃度，大利農爲 0.04% (1:1,500)，力拔山和速滅松各爲 0.05%(1:1,000) 而 Matacil 爲 0.075%(1:1,000)。每種殺蟲劑均以噴一次和兩次作比較，第一次於五十六年五月十九日噴射，第二次於同年六月五日噴射，相隔約十七日。噴施一次者在五月十九日噴射。對照區噴清水。處理區數爲 4 種殺蟲劑× 2 種噴施次數＋對照區計 9 處理。每處理重複 4 次，合計爲 36 小區，每小區供試之鳳梨 80 株。

試驗區乃設在高雄縣大樹鄉龍目村、陳石獅先生的鳳梨園。該鳳梨從種植起，未曾施用任何殺蟲劑，爲相當理想之供試材料。施藥前先調查各處理區鳳梨果實粉介殼蟲爲害率，以明瞭施藥前後之差別。

噴藥時鳳梨的熟度爲在採收之一至二個月前，亦約在謝花後一個半月開始噴藥。由冠芽、果實、果柄都全部噴到，尤需注意果實的基部，因該部位有裔芽及總苞葉存在，形成很多隱蔽的處所，所以粉介殼蟲大都棲息在該部位，噴藥時甚多阻隔，故需噴射週到。每株之施藥量雖多達 300cc，但噴施之藥液很少浪費，因噴在果實及芽體所餘流下來的藥液都流集於鳳梨的葉基，並可殺死在植株基部的粉介殼蟲，可謂一擧兩得。

藥劑處理後三週，即六月廿八日，有些果實已可以採收，乃於採收時，詳細調查果實、果柄及芽體等各部位粉介殼蟲之存在與否。每小區先後調查十株，每一處理合計調查四十株（表四）。

四、結果及討論

粉介殼蟲在鳳梨果實發生之週年調查，經前後六次調查結果，全省鳳梨果實受粉介殼蟲之爲害率平均高達29.43%，可謂相當嚴重。中以高雄區被害率最高達37.3%，次爲臺南33.5%及嘉義32.25%，再次爲南投 19.28%。在年中之發生仍以高溫時如三至六月之被害最高，十二至一、二月間因氣溫較低，粉介殼蟲發生較少，而七月因係雨期中，故其爲害率因雨量之驟增而被壓低下來。但是一年之中，均見有粉介殼蟲在鳳梨果實爲害，最低平均亦達 15.17%。

表四、鳳梨果實粉介殼蟲田間防治試驗

Table 4. Field evaluation on some insecticides for mealybug control on pineapple fruits

殺蟲劑 Insecticides	供試濃度或倍數 Concentration %	施藥次數 No. of application	施藥前粉介殼蟲爲害率%* %infestation of mealybug before application	施藥後粉介殼蟲爲害率%** %infestation of mealybug after application	防治率 % Control	被害部位 Portions of infestation (%)				
						果柄 Stalk	果基 Base of fruits	果端 Upper of fruit	冠芽 Crown	裔芽 Slips
Diazinon	0.04	1	50.63	2.5	96		2.5			
60%EC	(1:1500)	2	41.25	0	100					
Lebaycid	0.05	1	38.75	25.0	60	7.5	15.0	5.0		
50%EC	(1:1000)	2	48.13	5.0	92		2.5	2.5		
Sumithion	0.05	1	45.00	15.0	76	2.5	12.5			
50%EC	(1:1000)	2	49.38	7.5	88		7.5			
Matacil	0.075	1	36.88	25.0	60		25.0		2.5	2.5
75%WP	(1:1000)	2	44.38	10.0	84		10.0			
Check (Untreated)			43.33	62.5		40.0	42.5			

* 每處理調查160個果實。160 fruits were examined in each treatment

**每處理調查 40個果實。 40 fruits were examined in each treatment

粉介殼蟲在鳳梨結實時，由植株的基部經果柄移棲至果實基部及芽體，但在果基最多 (22.15%)，次爲果柄 (16.37%)，因該處較爲陰蔽，爲粉介殼蟲最喜棲息的地方。餘者依序爲裔芽 (2.6%)，冠芽 (1.35%) 及果實上部 (0.95%)。

鳳梨果實粉介殼蟲之防治，爲顧及施藥者及消費者之安全起見，經用數種毒性較低之殺蟲劑如大利農 (Diazinon 60%EC)，速滅松 (Sumithion 50%EC)，力拔山 (Lebaycid 50%EC)，馬拉松 (Malathion 50%EC,)，Ortho-9006 72%EC 及 Matacil 75% WP等先後於室內及田間作防治比較試驗。而由室內比較結果選效果較優之 Diazinon, Lebaycid, Sumithion 及 Matacil 等四種，每種殺蟲劑各以其效果較優而經濟之濃度一種，在田間作比較試驗。供試之鳳梨因未曾施用任何殺蟲劑，故其粉介殼蟲之爲害率相當高，由36.88%至50.63%。以上數種殺蟲劑比較試驗結果，以大利農 (Diazinon) 之0.04% (1:1,500) 之兩種處理效果最優，其中以施藥兩次者其防治效果高達100%，施藥一次者亦達96%，而力拔山 (Lebaycid) 之0.05% (1:1,000) 施藥兩次者其防治效果僅達92%，其他各處理之防治效果均未臻理想。

五、摘　　要

本省鳳梨果實粉介殼蟲之爲害率相當高，平均爲 29.43%，且年中均有，以三至六月份之爲害率較高，平均爲33.75%，至44.08%，而以十二月份最低，平均爲 15.17%。全省鳳梨果實粉介殼蟲之爲害率，以高雄地區37.3%爲最高，次爲臺南33.5%和嘉義32.25%，再次爲南投19.28%。粉介殼蟲在鳳梨果實，以果基及果柄爲最多，僅少數在裔芽及冠芽。至殺蟲劑之防治比較結果，在鳳梨謝花後一個半月左右以大利農 Diazinon 0.04% (1:1,500) 噴射兩次，每次相隔17天。每次每株噴300cc，其防治效果可達100%。

六、參　攷　文　獻

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Seasonal abundance of Mealybug (*Dysmicoccus brevipes* (Ckll.)) and Its Control on Pineapple Fruits

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Fengshan Tropical Hortriculture Experiment Station

Summary

Mealybug (*Dysmicoccus brevipes* (Ckll.)) has been satisfactorily controlled in Taiwan by using parathion at the concentrate of 0.0235% (1:2000) for slips dipping and followed by three times filling with the same material in field with an interval of three months. This remedy, for control the mealybugs which induce the wilt of pineapple, has been proved to be more effective to eliminate the wilt by suppressing the population of the pest on pineapple in the early stage(4). Therefore, the applications of insecticide to pineapple, for the purpose of wilt elimination, in the period about several months before blossom were not so important as those in the period within one year after planting. As a result, the survival of mealybugs will crawl up to the newly formed fruits and most of them establish on the portion between the upper end of stalk and the bottom of fruit, a less number of them on slips and crown only.

In recent years, fresh pineapple exporting has been developed rapidly, nearly twenty thousand metric tons of fresh fruit were exported annually. It has arrested our attention to the fruits on which mealybugs contaminated were not permitted to be exported.

A project of mealybug control on pineapple fruits was then laid out in order to solve the problem as it is mentioned above. Before the control program was put into action, a survey of seasonal abundance of mealybug on pineapple fruits was conducted in several districts, such as Nantow, Chiayi, Tainan and Kaohsiung, in which area pineapple was considered to be more concentrically grown.

Six investigations were given from December 1966 to August 1967. Fifty fruits of pineapple were examined in each field, two to four of which were randomly investigated in each district.

The result (Table 1) indicated that the infestation of mealybugs on pineapple fruits becomes more serious gradually from December to June as the temperature raises from month to month in this duration. But the infestation was suppressed to be lower in July since the rainfall that almost concentrates in the months from May to August. On the other hand, the infestation of mealybug in the investigated districts (Tab-

le 2) varied greatly frcm south to the middle of this island. It is also partially affected by the climate that is warmer crderly frcm Kachsiung to Nantcw. On the whole, mealybugs occur almost through the year on pineapple fruits and the mean percentage of infestation in this island is 29.43%.

The control program was carried out both in the laboratory and field. Six chemical compounds namely Orthc-9006 72%EC, Malathion 50%EC, Sumithion 50%EC, Lebaycid 50%EC, Matacil 75%WP and Diazinon 60%EC, etc., some of which have been used on banana for control the same mealybug as that on pineapple, were firstly tested at laboratory by dipping ten slips into each concentration fcr two minutes. Mortality was counted seven days after treatment. The result was given in Table 3.

Four compounds such as Diazinon, Lebaycid, Sumithion and Matacil which selected from laboratory screening were then tested in field. Insecticides were sprayed on fruits in the stage about two months before harvesting. Diazinon sprayed 300cc per plant at the concentrate of 0.04% (1:1500) for two applications at the interval of 17 days giving 100% control as it is showed in Table 4.